latitudes 34° to 37° N., longitudes 170° E. to 180°. Here westerly gales of force 8 to 9 occurred on the 5th and 6th. The lowest pressure, 988.5 millibars (29.19 inches) was read on the American S. S. *Associated,* near 36° N., 172° E., on the 5th.

Scattered gales were reported east of Japan on the 7th and 22d, west of the California coast on the eastern slope of a strongly developed HIGH on the 9th, and west of Washington on the 22d. The U. S. Coast and Geodetic Survey vessel *Discoverer,* while near the extremity of the Alaska Peninsula on the 2d, had an east-northeast gale of force 10, with little depression of the barometer.

Typhoons.—Subjoined is a report by the Rev. Bernard F. Doucette, of the Manila Observatory, on two Far Eastern typhoons of June. One formed in the China Sea on the 3d, passed over eastern Japan during the 5th to 6th, and was last observed east of the Kuril Islands on the 8th. Related to this storm's activities east of Japan was a southeast gale of force 10, lowest barometer 998 millibars (29.47 inches) reported by the American M. S. *Cape Alava,* near 40° N., 155° E., on the 7th.

The second typhoon originated among the Caroline Islands about the 23d, and was last observed near northern Japan on July 4. On June 28 it crossed northern Luzon, where it resulted in several deaths and caused much damage to communications and crops. On the 30th it struck Hong Kong as it passed inland and inflicted some destruction. According to press reports the wind at Hong Kong attained a maximum velocity of 92 miles.

Fog.—Doubtless owing to the reduced number of ships' reports, fog appeared abnormally infrequent for June along the western half of the steamship routes where, between Japan and the western Aleutians, it usually forms in abundance during early and middle summer. This month there were few 5° east-longitude ocean areas in which fog was reported on as many as 2 or 3 days. In middle latitudes of west longitudes fog was somewhat more frequent, and in the area 35° to 40° N., 160° to 165° W., it was observed on 4 days. Along the strip 32° to 41° N., 140° to 145° W., it was noted on 6 days between the 2d and 9th. Close along the coasts, it was reported on 1 day off Oregon, 3 days off California, and on 2 days in Lower California waters.

TYPHOONS AND DEPRESSIONS OVER THE FAR EAST

BERNARD F. DOUCETTE, S. J.
(Weather Bureau, Manila, P. I.)

Typhoon, June 3–7, 1941.—On the morning weather map, June 3, a depression appeared over the China Sea about 250 miles west of northern Luzon. This disturbance moved in a northeasterly direction across Balintang and Bashi Channels, close to and east of Formosa, along the Nansei Islands, across Japan and passed beyond the region of observation June 7 and 8.

As this storm moved along the Nansei Islands, the pressure values reported were below 750 mm. (999.9 mb.) generally, the lowest being that from Naha, June 5, morning report, namely 745.0 mm. (993.3 mb.) with south-southwest winds, force 6. Over Japan, June 6, there were a few stations reporting values between 741.0 and 745.0 mm. (987.9 and 993.3 mb.) as the center rapidly progressed toward the ocean. The storm entered the Pacific Ocean during the morning hours of June 7, and Nemuro had 729.0 mm. (971.9 mb.) with east-southeast winds, force 5 on the morning weather map. This storm was called a typhoon because of these pressure values and the squally, rainy weather which prevailed over the Philippines up to June 6. It may have had more of the characteristics of a severe extratropical depression rather than the vortex of a typhoon, but for forecasting purposes, it was called a typhoon to insure that proper precautions were taken. No reports of casualties were printed in the newspapers.

The southwest monsoon current had been slowly advancing toward the Philippines during the latter part of May, the winds at Manila changing to the southwest quadrant on May 25. The result of this change of wind system was a trough of low pressure over the northern part of the China Sea, the Balintang Channel, and adjacent Pacific Ocean regions. Over the western portion of this trough, the depression formed because of the activity of the southwesterly current. It seems that this current of air was the strongest of all the air currents moving toward the disturbance center. For about 9 days before any center appeared, the few reports of the upper winds received from stations of Indochina and Thailand indicated that the southwesterly air stream had velocities over 50 km./hr. at various levels during this whole period and it is assumed by the writer that this air was forced toward the northern part of the China Sea before the disturbance formed. After the center had moved in a northeasterly direction for 1 day, the Philippines felt the strength of this current, intensified by the deepening center then northeast of Formosa. Velocities between 30 km./hr. and 70 km./hr. persisted over the Philippines until the storm had crossed Japan.

Typhoon, June 23–July 4, 1941.—A depression formed about 300 miles east-southeast of Yap during the morning hours of June 23. It moved in a northwesterly direction, gradually inclining to the west-northwest and then west, intensifying to typhoon strength near latitude 13°, longitude 134° during the afternoon hours of June 24. June 26, afternoon and evening, the typhoon was moving westerly along the 14th parallel of latitude and threatening the northern part of Catanduanes Island. When about 50 miles from this island, it changed its course to the northwest, avoiding southern Luzon and threatening northern Luzon. During the late night hours of June 27, the center moved across the island, passing close to and north of Palanan, Isabela Province, then between Aparri and Tuguegarao, Cagayan Province, and finally moved into the China Sea over a course close to and north of Laoag, Ilocos Notre, during the forenoon hours of June 28. A change from the northwesterly to the westerly direction occurred a short distance east-southeast of Hong Kong, and thus the center passed close to and south of the city, June 30, afternoon and evening. July 1 and the following days showed the center, very much weaker, recurving to the northeast over the Continent, and crossing the Yellow Sea, and the Sea of Japan into Japan.

According to available newspaper reports on July 2, the total loss of life during the progress of this typhoon was 19. Ten of these persons were killed in the Philippines and the rest were residents of Hong Kong. Considerable damage to crops resulted over the Philippines because of this typhoon.

The barometric minima reported from Philippine stations are as follows: Virac, Catanduanes Island, had 743.45 mm. (991.2 mb.) as the lowest value, June 27, 1:05 a. m. Palanan, Isabela Province, reported 711.23 mm. (948.2 mb.) occurring at 9:30 p. m., June 27. Tuguegarao, Cagayan Province, had its minimum at 1:50 a. m. June 28, namely 728.8 mm. (971.6 mb.). Aparri, Cagayan Province, experienced its minimum a short time after Tuguegarao, namely 3:15 a. m., 739.92 mm. (986.5 mb.) being the value. Laoag, Ilocos Norte, is the last of the stations, the minimum occurring just before the center entered the China Sea, and amounting to 738.5 mm.

(984.6 mb.) felt at 7:00 a. m. June 28. All of these values have been corrected for gravity.

Before this typhoon formed and during its progress, the few pilots received from Indochina and Thailand indicated that the southwest monsoon current was persistently strong, that is, with velocities over 50 km./hr. No reports are available from Netherlands East Indies, and these are necessary to show whether or not there was a southwesterly air stream of any strength moving toward the Western Caroline Islands before the storm center manifested itself by a fall of pressure at Guam and Yap, on June 23. The pilots at Guam showed that a mild surge from the east quadrant took place together with a shift to the southeast quadrant as the pressure began falling at Yap. Up to June 26, the upper winds over the Philippines were more from the northwest quadrant than from the southwest quadrant, Aparri excepted, where east quadrant winds predominated aloft. While the typhoon was over the ocean and moving westerly toward the northern part of Catanduanes Island, the reports from Indochina and Thailand, especially the two stations Saigon and Bandon, showed that the southwest monsoon current was very active. Not until the June 26 pilots from Zamboanga arrived was there any indication that the strong southwesterly current had crossed the China Sea to join the typhoon circulation. From this time on (i. e., after June 26), the center changed its course to the northwest and rainy and squally weather prevailed over the Philippines. The upper winds at Aparri changed somewhat to the northeast and north as the center approached northern Luzon, and shifted to the southeast on June 28, reporting velocities of 100 km./hr. and over when in this air stream. On June 30, when the typhoon center was near Hong Kong, the pilots from stations of northern Indochina clearly showed the different air streams connected with the typhoon and flowing over that locality, namely southwest quadrant winds below and north quadrant winds above.

RIVER STAGES AND FLOODS

By BENNETT SWENSON

Widespread precipitation, excessively heavy in some sections, resulted in considerable flooding during June 1941. Floods were particularly severe in portions of Kansas, Nebraska, Oklahoma and Texas, and in New Mexico during May and June. The floods in the Blue and Solomon Rivers in Kansas and Nebraska were the greatest of record. In the Trinity River the highest flood since 1908 occurred in the upper reaches between Dallas and Trinidad, Tex. Since the flooding continued at some of these points at the end of the month and inasmuch as complete reports are not yet available, a full discussion of the floods in the Missouri, Arkansas and Red River, and the west Gulf of Mexico drainage basins will be given in a later issue of the REVIEW.

The rainfall amounts during June were abnormally heavy generally in the Great Plains States from the Canadian border to the Rio Grande. Also in the Great Basin of the West the amounts were heavy, averaging as much as three times the normal precipitation.

East of the Mississippi River, where May was extremely dry, the rainfall during June was heavy in many areas. The New England States, New York, Michigan, Wisconsin, Tennessee, Alabama, and Mississippi had less than normal rainfall, but all other States had precipitation above normal; South Carolina had the wettest June in 35 years.

Atlantic Slope drainage.—River stages showed a rise during the month, but on the whole they were still unusually low at the end of the month. Flood stage was reached or slightly exceeded only at Rimini and Ferguson, S. C., in the Santee River, near the end of June.

Upper Mississippi River Basin.—No floods occurred in the main channel of the Mississippi except that flood stage was reached or slightly exceeded at Louisiana and Hannibal, Mo., during the month. Water levels were considerably above normal pool due to greater discharge from extended periods of rainfall.

Pronounced rises occurred in the smaller tributaries due to excessive thunderstorm rains. A flood occurred in the Root River Valley in extreme southeastern Minnesota on June 13 and 14. Some land was flooded and the damage was mainly agricultural. The only other tributary flooding reported was in the Rock River where the stage at Moline, Ill., was slightly above flood from June 4 to 6.

Missouri, Arkansas, and Red River Basins.—Extensive flooding occurred in most of the streams of Kansas, Nebraska, southwestern Iowa, northwestern Missouri, and in Oklahoma during June. In the Big Blue and Solomon Rivers in Kansas and Nebraska the highest stages of record were reached. A full report of these floods will be made in a later issue of the REVIEW.

Ohio River Basin.—The following report is made by the Official in Charge, Pittsburgh, Pa., in connection with floods in his district which comprises the Ohio River Basin at and above Wheeling, W. Va.:

The rivers in the Pittsburgh district were low during the last week in May, and the ground water considerably depleted. A showery condition set in on May 30, and continued almost daily until June 3, but there was not enough run-off from the rains to reach the rivers until the 3d, when the main rivers became stationary and slight rises occurred at scattered points, indicating that the ground had reached a fairly high percentage of saturation.

During the afternoon and night of the 3d, rains were heavy over the Monongahela Basin, and light to moderate over the Allegheny. These rains caused a rise of a few tenths of a foot in the Allegheny River, and from 7 to 11 feet in the Monongahela by 7 a.m. of the 4th. The upper Youghiogheny River rose 3.4 feet at Connellsville, Pa., and 4.8 feet at Confluence, Pa., by 7 a.m. of the 4th, and the Cheat River rose 3.9 feet at Rowlesburg, W. Va.

Heavy rains occurred again of the 4th, mostly in the afternoon extending over practically all of the district, but with the greatest concentration over the middle Monongahela Basin, where the heaviest rains had occurred on the 3d. The rains were unprecedented for several of the southwestern counties in Pennsylvania, and adjacent counties in West Virgina, being in excess of 6 inches for the 24 hours ending at 7 a.m. of the 5th. At Brownsville, Pa., Government lock No. 5, the precipitation on the morning of the 5th measured 6.27 inches. This heavy downpour quickly raised the tributaries in southwestern Pennsylvania and northern West Virgina to heights heretofore unknown. At the town of Brave, Green County, Pa., where Dunkard Creek normally is about 30 feet wide, and the bed of the creek about 15 feet lower than the general level of the ground, the water rose over the banks, and over the tops of automobiles on the highway. Inhabitants state that the crest of the rise came in about 30 minutes.

The water from these short tributaries quickly reached the Monongahela River at and below Greensboro, Pa., Lock No. 7, passing the flood stage of 30 feet by noon of the 4th and reaching a crest of 35.8 feet by 6 p.m.

The 7 p.m. reports on the 4th showed that the heavy rains were still in progress and the Monongahela and its tributaries still rising. Forecast that stages at Pittsburgh would exceed the flood stage of 25 feet was first issued at 10 p. m. of the 4th. The forecast called for 25 to 26 feet by 2 p. m. of the 5th.

On the morning of the 5th, the rain had ended. The Allegheny River was rising slowly, the upper Monongahela was falling, and the Youghiogheny was falling at the headwaters, and about stationary in the lower river. On the basis of these conditions, a forecast was issued at 9 a. m., for 27.0 feet at Pittsburgh by 3 p. m. of the 5th, and 31.0 feet at Wheeling by 8 a.m. of the 6th. The forecast for Wheeling was again revised at 3 p. m. of the 5th, to between 33 and 34 feet by 8 a. m. of the 6th. The actual crest reached at Pittsburgh was 26.9 at 4:25 p. m. on the 5th. At Wheeling the crest was 33.8 feet at 9 a. m. of the 6th.